PROSPECTIVE ASSESSMENT OF THE EFFECT OF TRANSURETHRAL RESECTION OF PROSTATE ON THE SEXUAL FUNCTION

DISSERTATION

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CERTIFICATE

This to certify that the work incorporated in this dissertation entitled **"PROSPECTIVE ASSESSMENT OF THE EFFECT OF TRANSURETHRAL RESECTION OF PROSTATE ON THE SEXUAL FUNCTION"** is a bonafide work done by **Dr. Pradeep** in partial fulfillment of the rules and regulations of MCh Branch IV (Genitourinary Surgery) examination of the Tamil Nadu Dr. M. G. R Medical University Chennai to be held in August 2011.

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Table of Contents

INTRODUCTION

Introduction

The male sexual dysfunction includes three components, namely-

- erectile dysfunction (ED);
- ejaculatory dysfunction (EjD); and
- hypoactive desire (HD); loss of desire or decreased desire.

All these symptoms are seen common in elderly. Until recently, it was widely assumed that symptoms of male sexual dysfunction were a natural consequence of the aging process. A decrease in sexual function and sexual activity is not an inevitable consequence of aging.

Older individuals retain significant interest in sexuality and a large proportion of older men and women remain sexually active. [1, 2] Furthermore, sexuality is a factor that correlates with individuals' perception of their well-being and quality of life.[3] With the development of new measures for assessing sexual function and new medications for the treatment of ED, effective management of sexual problems is now possible.

BPH is a common medical condition in middle-aged and elderly men worldwide. Because ED also has a high prevalence in elderly men, many groups have assessed whether any causal relationship between BPH and sexual function exists.[2, 4 - 7] Some evidence supports the theory that BPH and ED are simply coexisting, age related conditions in aging men that are linked by several of the metabolic and hormonal changes that usually affect such men without significant correlation between the prostate size, lower urinary tract symptoms (LUTS) and ED.[4] On the other hand, a few recent reports show a direct correlation between the two diseases even after controlling for age, medications and concomitant comorbidities. [2, 5-7]

Transurethral resection of the prostate (TURP) has been considered the standard surgical therapy for lower urinary tract symptoms secondary to benign prostatic enlargement (BPE). [8] Its high success rate is reflected by substantial improvements in symptom scores, urinary flow rate, post-void residual urine (PVRU) and a low retreatment rate on long-term follow-up. This has become the yard stick to compare the outcome of newly introduced minimally invasive trans-urethral procedures.

The effect of TURP on sexual function is uncertain and available evidence is conflicting. As detected in the multicenter American Urological Association Cooperative Study, based on 1,000 men with adequate data available the rate of postoperative ED was 13%.[8] In contrast, results in a recent report of Leliefeld et al showed no association between BPH treatment and postoperative sexual dysfunction.

In a study examining patients' own evaluation of sexual dysfunction after TURP, 54% of the responders claimed deterioration and half blamed the operation, but the actual rate was less as confirmed by more objective reports.[10]

The results are variable, the older studies could possibly be an over estimation, possibly because of the use of different instruments for assessment, good number of them were not standardized tools to assess erectile function, and also because most of these were retrospective assessments of erectile function & on many a occasions without pre-TURP assessment of sexual function. The availability of standardized, reliable, self-assessment questionnaires has made a significant impact on the outlook of assessment of erectile and overall sexual function in the setting of clinical trials.

AIMS OF THE STUDY

Aims of the study

Aim: To study the effect of Transurethral resection of prostate (TURP) on sexual function

REVIEW OF LITERATURE

Review of Literature

Anatomy pertinent to penile erection & TURP is reviewed.

NEUROANATOMY OF PENILE FUNCTION

Anatomy of the innervation of penis for erection in humans was first reported by Muller in 1836.[11] Innervation of penis is both autonomic (sympathetic & parasympathetic) and somatic (sensory & motor).

Parasympathetic preganglionic input originates in the sacral (S2– S4) spinal cord.[12] S3 is the main source of erectogenic fibers. The preganglionic fibers from the sacral roots form the pelvic nerves (pelvic splanchnic nerves or nervi erigentes) and are joined by fibers from the inferior hypogastric nerves (sympathetic) to form the pelvic plexus[13] *(31)*, (syn inferior hypogastric plexus). The nerves run in the pelvic fascia on the lateral side of the rectum, seminal vesicles, prostate, and posterior bladder.

The sympathetic preganglionic fibers to the penis arise from the upper lumbar and lower thoracic segments of the spinal cord (T10–L2). The fibers pass through the corresponding chain ganglia, to synapse in the ganglia of the superior hypogastric plexus, or the presacral nerve. This nerve subsequently divides into left and right hypogastric nerves, descending to the inferior hypogastric, or pelvic plexus. The hypogastric nerves contain postganglionic sympathetic fibers.

The somatosensory pathway originates at the sensory receptors in the penile skin, glans, and urethra and within the corpus cavernosum. The nerve fibers from the receptors converge to form bundles of the dorsal nerve of the penis, which joins other nerves to become the

pudendal nerve. It enters the spinal cord through the S2-S4 roots to terminate on spinal neurons and interneurons in the central gray region of the lumbosacral segment.[14]

Activation of these sensory neurons sends messages of pain, temperature, and touch by means of spinothalamic and spinoreticular pathways to the thalamus and sensory cortex for sensory perception.

Onuf's nucleus in the 2nd to 4th sacral spinal segments is the center of somatomotor penile innervation. These nerves travel in the sacral nerves to the pudendal nerve to innervate the ischiocavernosus and bulbocavernosus muscles. Contraction of the ischiocavernosus muscles produces the rigid-erection phase. Rhythmic contraction of the bulbocavernosus muscle is necessary for ejaculation.

Anatomy of the cavernous nerve in humans was first reported by Muller in 1836.[11]

The cavernous nerve is a branch of the pelvic plexus with parasympathetic and sympathetic postganglionic fibers and innervates the penis. The cavernous nerve runs with branches of the prostatovesical artery and veins as part of the neurovascular bundle of the prostate. After passing the tip of the seminal vesicle and the nerves within the leaves of the lateral endopelvic fascia near its juncture with Denonvilliers' fascia, the cavernous nerve travels at the posterolateral border of the prostate and on the surface of the rectum. Passing posterolaterally to the prostate, the bundle emits fine branches to supply the prostatic capsule. At the prostatic apex, the nerve passes very near to the urethral lumen at the 3 and 9 o'clock positions and enters the penile crura more anteriorly, at 1 and 11 o'clock. The cavernous nerves represent the final pathway for vasodilator and vasoconstrictor neural input to the cavernous smooth muscles.[12]

Stimulation of the pelvic plexus and the cavernous nerves induces erection, whereas stimulation of the sympathetic trunk causes detumescence. For rigid-erection production in normal men, cerebral impulses travel as follows: through the sympathetic pathway, inhibiting norepinephrine release; through the parasympathetic, releasing NO and acetylcholine; and through the somatic, releasing acetylcholine.

It leaves the pelvis between the transverse perineal muscles and the membranous urethra, passing below the arch of the pubic bone to supply each corpus cavernosum. The cavernous nerve divides into two branches.

> The lesser cavernous nerve, supplies the erectile tissue of the corpus spongiosum and the penile urethra.
>
> The outer, greater cavernous nerve remains beneath the prostatic venous plexus and enters the corpora cavernosa around the cavernous vessels in the hilum of the penis.

Human cadaveric dissection has revealed medial and lateral branches of the cavernous nerves (the former accompanying the urethra and the latter piercing the urogenital diaphragm 4 to 7 mm lateral to the sphincter) and multiple communications between the cavernous and dorsal nerves.[15]

Parasympathetic efferent stimulates secretion in men from the bulbo-urethral and Littre's glands as well as from the seminal vesicles and prostate.[16]

The process of ejaculation involves two steps: emission and ejaculation proper. Emission consists of the deposition of secretions from the peri-urethral glands, seminal vesicles, and prostate as well as sperm from the vas deferens into the posterior urethra. The accumulation of

this fluid precedes ejaculation proper by 1 to 2 s and provides the sensation of ejaculatory inevitability. Emission is under sympathetic control from the presacral and hypogastric nerves that originate in the T10–L2 spinal cord levels.[16] Ejaculation proper (projectile ejaculation) involves sympathetic outflow regulated closure of the bladder neck, the opening of the external urethral sphincter, and contraction of the bulbo-urethral muscles for propulsion of the ejaculate. These are striated muscles innervated by somatic fibers carried in the pudendal nerve. Orgasm can occur despite damage to the sympathetic ganglia; however, it is rarely possible after injury to the pudendal nerve.

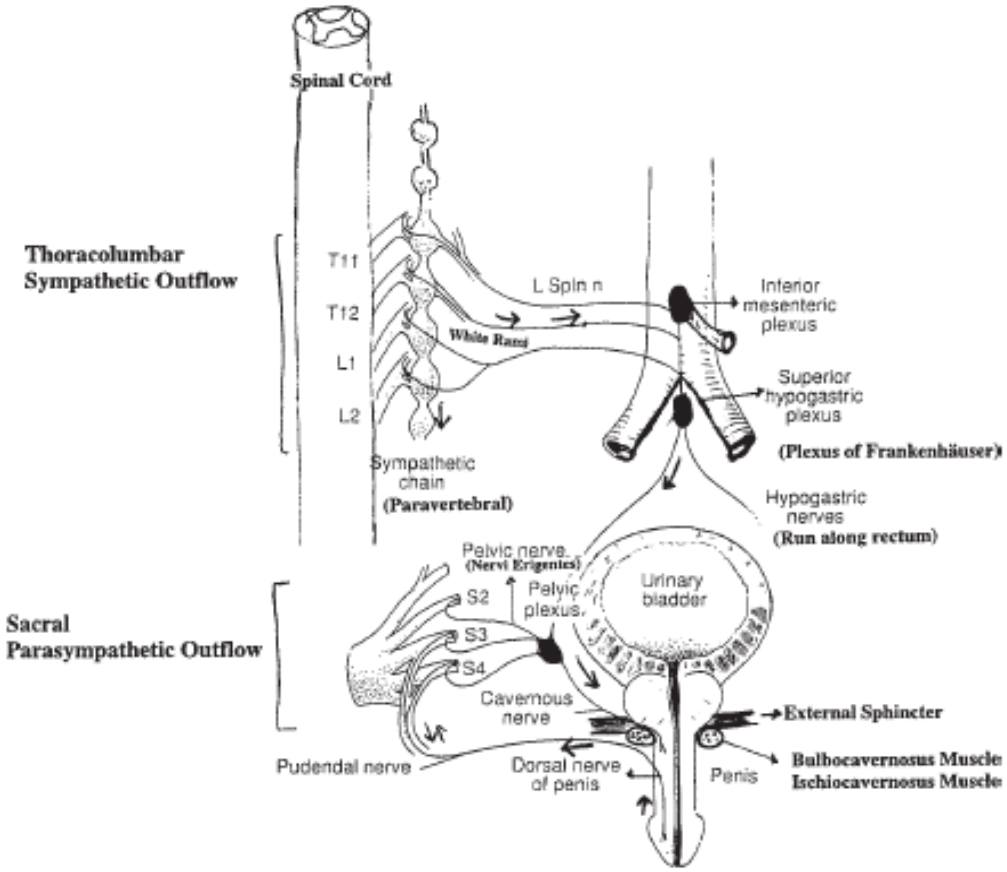


Fig. 5. Schematic representation of neural innervation of the pelvic structures and penile erection.

Adapted from P Milhoua, D Lowe & A Melman: Male sexual function, Normal anatomy & physiology. Second edition, pg 12, Humana press, New Jersey 2006.

Muller emphasized multiple nerve filaments running from the hypogastric or pelvic plexus to the prostatic plexus situated posterolaterally at the base of the prostate, and then coursing posterolaterally along the prostate to the cavernous plexus at the base of penis. In Muller's original thesis, the periprostatic plexus-like anatomy of the cavernous nerve was clearly described. Muller distinguished a major and several minor cavernous nerves.[11]

Walsh helped revolutionize radical prostatectomy by defining the neurovascular bundle (NVB) that can be preserved in appropriate patients. The nerve-sparing procedure was initially described by Walsh on the basis of the traditional concept that the nerve fibers responsible for erectile function run exclusively in the neurovascular bundle (NVB) on the postero-lateral aspect of the prostate.

The recent micro-anatomical studies have also indicated a significant amount of nerve fibers along the ventral circumference of the prostatic capsule, forming a periprostatic nerve network. By using electro-physiologic testing, the present study indicates that periprostatic nerve fibers along the anterior and lateral circumference of the prostatic capsule also contribute to erectile function, along with nerve fibers in the NVB at the posterolateral circumference of the prostate.

The traditional concept that the nerve fibers responsible for erection run exclusively in the NVB has thus been replaced by the recent concept of the periprostatic nerve network. [18,19]

Lunacek et al described the changing course of cavernosal nerves during fetal development and the growth of the prostate with benign prostatic hypertrophy (BPH) in an extensive histologic study of 29 fetal and 8 adult male specimens. They found that the cavernosal nerves, which run downward laterally and dorsally during early gestation, became displaced

further laterally and anteriorly along the convex surface of the prostate with the growth and increasing volume of the prostate after gestational week.[11]

Epidemiology

ED or impotence is defined as ‘‘the inability of the male to achieve an erect penis as part of the overall multifaceted process of male sexual function.’’

The Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition–Text Revision (DSM-IVTR), diagnostic criterion set for Male Erectile Disorder

A. There is a persistent or recurrent inability to attain or to maintain until completion of the sexual activity an adequate erection.

B. The disturbance causes marked distress or interpersonal difficulty.

Classification, Etiology & Risk factors for ED

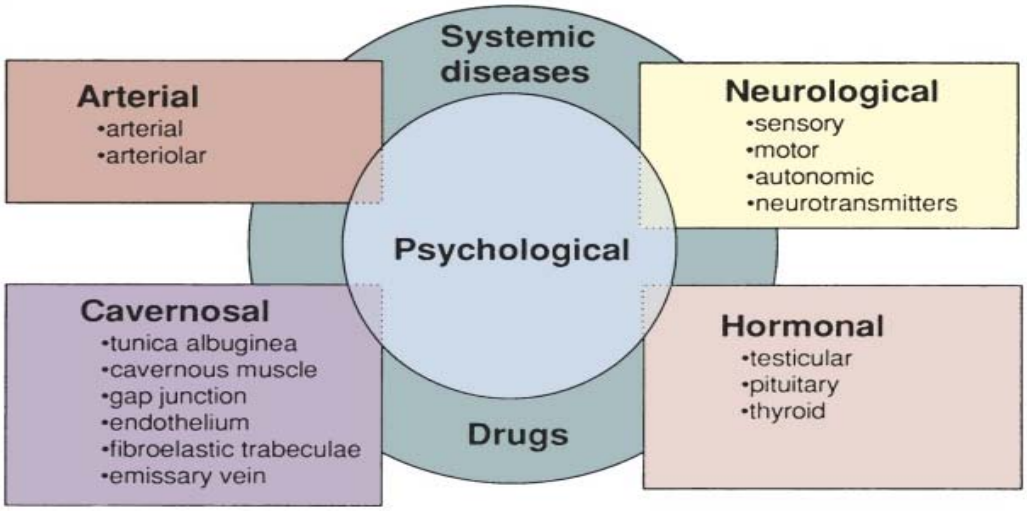
Erectile dysfunction can be classified based on the etiology (diabetic, iatrogenic, traumatic), or on the neurovascular mechanism (failure to initiate [neurogenic], failure to fill [arterial], and failure to store [venous].

Risk factors

Common risk factors associated with sexual dysfunction include age, the general health status, diabetes mellitus, cardiovascular disease, concurrence of genitourinary disease, psychiatric or psychologic disorders, other chronic diseases, and socio-demographic conditions.

Etio-pathogenesis

These factors in isolation or together can cause erectile dysfunction. The etio-pathogenesis is depicted in this schematic diagram.



Adapted from TOM F. LUE, Campbell-Walsh Urology, 9th ed Chapter 21 – Physiology of Penile Erection and Pathophysiology of Erectile Dysfunction Saunders 2007

Importantly, it has not been determined how much the two conditions LUTS & ED influence each other and whether the normal aging process can be considered the main factor in the pathophysiology of both ED and LUTS.

Many tentative theories have been proposed to explain the association between ED and LUTS, as the ‘‘common-theme’’ hypothesis. Organic or psychogenic factors could be the mechanisms for ED in men with LUTS.[20, 21]

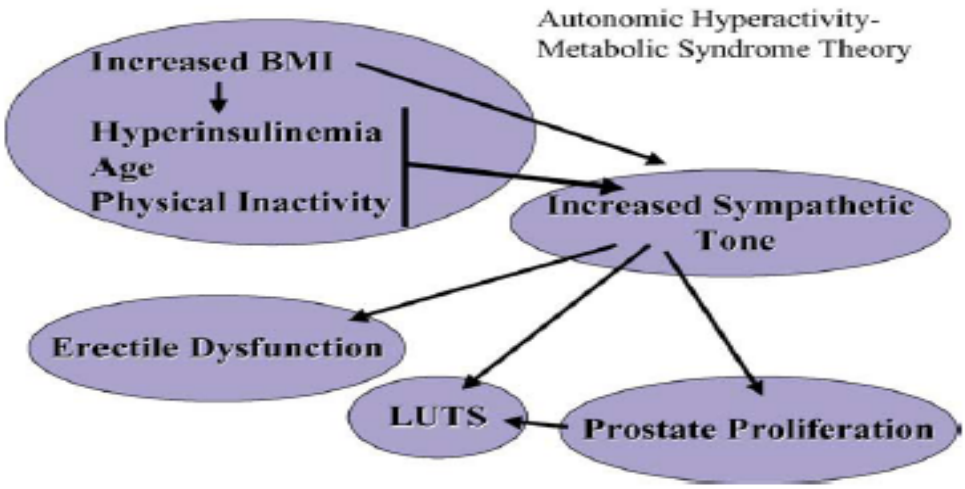
Four leading possible mechanisms of how these diseases LUTS & ED interrelate were suggested, e.g. the nitric oxide synthase/nitric oxide theory,[23] autonomic hyperactivity effects on LUTS and ED[24], increased Rho kinase activation/downregulation of endothelin-B receptor sites[25] and prostate and penile artherosclerosis.[26] Anatomic factors due to the enlarged prostate were proposed to have advert effects on erectile function.[27]

Important ED risk factors, such as diabetes and ischemic heart disease (IHD) also negatively affect the penile vascular status.[28, 29] However, the association between vascular abnormalities and both ED and LUTS has not been confirmed.

Possible common components linking LUTS / BPH, ED & EjD

Possible links	LUTS / BPH	ED	EjD
↑ α - adrenergic activity	✓	✓	✓
Alteration in α_1 –adrenergic receptor subtypes	✓	✓	✓
↓ NO bioactivity (endothelial dysfunction)	✓	✓	?
Testosterone / estrogen imbalance	✓	✓	✓
5 – HT	?	✓	✓

Age-related changes in circulating hormone levels and an imbalance in the testosterone / estrogen ratio may play a role in the pathophysiology of BPH and sexual dysfunction. Longitudinal data from the MMAS indicated that serum levels of total testosterone, dehydroepiandrosterone (DHEA), DHEA-sulfate, cortisol, and estrone declined, whereas levels of DHT, sex hormone binding globulin, luteinizing hormone, follicle-stimulating hormone, and prolactin increased in men who were aged 40 to 70 years at baseline and followed for 7 to 10 years.[30]



Proposed theory of autonomic hyperactivity of LUTS & ED. Increased autonomic activity resulting from BMI, hyperinsulinemia, increased age & decreased physical activity effects BPH growth, LUTS & vasomotor forces that result in ED.[24]

Risk factors have been evaluated for their relative risk of causing ED in this study by krimpen study by blanker[31].

Risk factors	Relative risk
Age (55–78)	2.3–14.3
BMI >30	3.0
LUTS	1.8–7.5
Cardiac Surgery	2.5
COPD	1.9
Smoking	1.6

The large variation in LUTS related Ed risk relates to the severity of the IPSS score

Age is one of the most important risk factors for ED. Compared to men in their 5th decade men in their 6th decade have a 2-fold increase in their relative risk (RR) of ED. The RR increases to 5-fold for men in their 60s.[30, 31]

Worldwide the prevalence of ED, studies conducted between 1993 and 2003, stratified by age showed a rising prevalence of ED. Between the ages of 40 and 70 years, the probability of complete ED increased from 5.1% to 15%, moderate dysfunction increased from 17% to 34%, and mild dysfunction remained constant at about 17%. Before age 40 the rate was 1% to 9%; from 40 to 59 it ranged from 2% to 9% to as high as 20% to 30%.

Studies from other countries had noticed that the prevalence of erectile dysfunction increases with age, which was noted as early as the 1940s. Two studies on the prevalence of ED in the general population are-

1. Massachusetts Male Aging Study (MMAS) and

2. National Health and Social Life Survey (NHSLS).

General population studies Data from the National Health and Social Life Survey (NHSLS), a population-based representative sample of US adults aged 18 to 59 years, demonstrated a high prevalence of sexual dysfunction in men (31%) and women (43%).[28] A study of 2476 Spanish men aged 25 to 70 years indicated that the prevalence of ED was 12% to 19%, with the rate dependent on the self-administered questionnaire used to assess sexual function.[29] The results of the NHSLS indicated that LUTS was a significant predictor for ED.

MMAS was the first large-scale, community-based study on ED in non-institutionalized 40 to 70-year-old men in the Boston area. Amongst the total of 1290 men aged 40–70 years 52% of

men reporting some degree of erectile dysfunction—mild in 17.1%, moderate in 25.2% and complete in 9.6s. %. The prevalence of complete ED was age-dependent, increasing from 5% for men aged 40 years to 15% for those aged 70 years[2].

LUTS & Erectile dysfunction

Lower urinary tract symptoms (LUTS) related to benign prostatic hyperplasia (BPH) and sexual dysfunction (SD) are highly prevalent in men over the age of 50.[34]

The prevalence of ED and LUTS in older men may be as high as 52% and 32% respectively. Community-based studies underlined that sexual satisfaction negatively correlates with increasing age and LUTS.[20]

Several recent analyses[1, 2, 20- 22, 32] strongly suggest that although age is an independent risk factor for both LUTS and SD, LUTS is also an independent risk factor for SD.

Treatment of LUTS and BPH which includes pharmacologic, minimally invasive, and surgical therapies could also have an impact on sexual function.

The Multinational Survey of the Aging Male (MSAM-7) is the most comprehensive study conducted to date on the association of age, LUTS, concomitant comorbidities, and male sexual dysfunction (both ED and EjD). It is a large-scale, multinational survey of approximately 14,000 men 50 to 80 years old from United States and 6 European countries.[2] The results of this study confirmed the relationship between LUTS and sexual dysfunction in men, independent of the effects of age, other comorbidities, and lifestyle. The overall prevalence of ED in the MSAM-7 was 49%, with 10% reporting complete absence of

erections. The prevalence of ED was age-dependent, with rates of 31%, 55%, and 76% in men aged 50 to 59 years, 60 to 69 years, and 70 to 80 years, respectively.

The MSAM-7 study revealed a strong association between the level of sexual activity and IIEF score with patients' IPSS score.[2] The association between LUTS and ED persisted, even when controlled for age and other co-morbidities, that are known to impact sexual function. Other measures of ejaculatory dysfunction, reduced ejaculate and ejaculation pain also strongly associated with LUTS.

Importantly, the overall prevalence of EjD (defined as ejaculation with decreased amount of semen or loss of ejaculation) in men able to achieve erections was 46%, with 5% of the men reporting complete absence of ejaculation.

As was observed with ED, the prevalence of EjD was age dependent, with rates of 29%, 55%, and 74% in men aged 50 to 59 years, 60 to 69 years, and 70 to 80 years, respectively. Both ED and EjD were also significantly associated with the severity of LUTS ($p < 0.001$). Age and LUTS were stronger risk factors for ED and EjD than was diabetes, hypertension, heart disease, or hyperlipidemia.

A cross-sectional community-based survey investigated the possible role between sexual function and LUTS noted that sexual satisfaction negatively correlated with increasing age and LUTS. The relative risk of ED stratified by International Prostate Symptom Score (IPSS) ranged from a relative risk 1.0 at IPSS 0 to a 3.3 fold increase in relative risk for IPSS greater than 19. [21]

In the Cologne Male Survey of approximately 5000 German men aged 30 to 80 years, the overall prevalence of ED was 19%, with a significant association between ED and LUTS,

hypertension, diabetes, and pelvic surgery.[1] The prevalence of LUTS was 72% in men with ED versus 38% in those without ED. An additional analysis of the Cologne Male Survey data used multifactorial methods to show that, in addition to age, diabetes, hypertension, and pelvic surgery, LUTS is an independent risk factor for ED.[6]

The multinational UrEpik study performed in regions of the UK, the Netherlands, France and Korea demonstrated an unequivocal association between ED and LUTS ($p < 0.001$). It investigated the relationship between LUTS and sexual dysfunction in 4800 men aged 40 to 79 years.[35] The overall prevalence of ED was 21%, which was significantly associated with increasing age ($p < 0.001$). After adjusting for age and country, men with diabetes, hypertension, or LUTS had a greater risk of ED.

Similarly, the Krimpen study of sexual dysfunction assessed the relative risk (RR) for ED in a community cohort.[31] In this important study, LUTS had a strong relationship with increasing risk of ED (dose response curve). The authors noted an increased RR of ED from 1.8 to 7.5 depending upon the degree of urinary complaints. This increased RR of ED based on the severity of LUTS was greater than that found with the more traditional ED risk factors (cardiac symptoms, pulmonary problems and a history of smoking. This suggests that ED is a worthwhile symptom to question among patients who present with LUTS.

ED prevalence in correlation with LUTS severity

	45–60 years	61–75 years	>75 years	Total
	Diagnosed with ED			
IPSS				
0–7	169 (48.4%)	250 (53.6%)	33 (71.7%)	513 (53.4%)
8–19	786 (57.6%)	1621 (65.3%)	139 (58.4%)	2815 (62.3%)
20–35	142 (64.3%)	392 (73.5%)	44 (77.2%)	640 (71.1%)
No IPSS available	392 (63.3%)	767 (70.2%)	63 (64.9%)	1478 (67.7%)
total	1489	3030	279	5446

Adapted from the Krimpen Study by Blanker et al[31]

Based on the possible common pathophysiological mechanisms of LUTS/BPH and sexual dysfunction as well as other common comorbidities observed in aging men with these conditions, further multidisciplinary studies seem warranted preliminary data have suggested that treatment with sildenafil improves LUTS in men with ED, possibly as the result of smooth muscle relaxation in the lower urinary tract.[36]

Recent data from an open-label study have suggested that treatment with Alfuzosin 10 mg OD for 1 year significantly improves ED, EjD (defined as ejaculation with decreased amount of semen or loss of ejaculation), and pain/discomfort during ejaculation in men with LUTS associated with BPH.[37]

In 2 randomized, double-blind, placebo-controlled studies in men with BPH, treatment for 13 week with Doxazosin, which was titrated to 8 mg OD, resulted in significant improvements from baseline for those patients who had sexual dysfunction to start with.[38] Furthermore, in an observational study of men with BPH, treatment with Doxazosin for 1 month resulted in a significant improvement in sexual function compared with that at baseline, especially for those with moderate-to-severe ED at baseline.[39]

TURP & Erectile dysfunction

TURP is the reference standard in the surgical treatment for BPH[8]. The question of whether and to what degree a transurethral resection of the prostate (TURP) has an influence on sexual function has been widely evaluated. Its influence on the sexual function is uncertain and the available data is conflicting.

The impotency seen immediately after TURP may be temporary. A study in potent men using the snap-gauge test 4 days and 3 months after TURP showed a high impotency rate in the immediate postoperative period which significantly improved at retesting.[40] Neuropraxia from thermal injury or the emotional stress of surgery have been proposed as possible mechanisms.[41] It is important to note, however, that a good number of these studies were retrospective and that a preoperative examination of erectile function was not performed. The high percentage of postoperative retrograde ejaculation is viewed as a negative influence on sexuality. Often, it is difficult for patients to differentiate between ejaculatory and erectile dysfunction.

Etiology

The etiology of erectile dysfunction following TURP has not yet been established. It may be associated with age or a preexisting dyserection.[42]

Psychological changes following TURP or a loss of antegrade ejaculation can impair erectile function[43, 44] but a genuine organic erectile dysfunction may certainly be encountered. Various hypotheses have been advocated, including cavernous nerve injury, fibrosis or thrombosis of the cavernous arteries, fibrosis of the corpora cavernosa and venous leakage.[40]

The exact mechanism of small nerve fiber damage during TURP remains undetermined. Capsular perforation is known to be a risk factor for impaired post-operative erectile function.[43] This could be due to a direct injury of the cavernous nerves that run at a few millimeters from the prostatic capsule, inflammation due to extravasation of irrigation fluid or that of mechanical stress.[45.]

Theoretically, during TURP the HF-generated current close to the capsule may damage the neurovascular bundles. This could happen if the gland is resected beyond the capsule entering the venous sinus with efforts to control bleeding in that area. The rate of impotence varies from 3.4 to 32% in the literature [46, 47] However, there are also reports of improved erections after TURP.[48]

a. TURP & worsening erectile function

Surgical interventions for LUTS/BPH, such as TURP, have been reported to cause ED and EjD (particularly retrograde ejaculation). The estimated incidence of ED in a meta-analysis was 10% in 15 trials (versus 2% for sham control) and the estimated incidence of EjD was 65% in 19 trials (versus 2% for sham control) that had TURP as the control arm.[49]

In a multicenter American Urological Association Cooperative Study, based on 1,000 men the rate of postoperative ED was 13%[8]. In a prospective study with over 500 subjects undergoing TURP, the incidence of erectile dysfunction following TURP as assessed by IIEF-5 questionnaire was noted to be 12% and presence of diabetes mellitus and observed intra-operative capsular perforation were the risk factors identified associated with occurrence of erectile dysfunction[50].

A study from 1987 showed a postoperative impotence rate of approximately 30% at 1 month following TURP.[51] In the follow-up this high rate fortunately decreased to approximately 20%, and it was thought to be a frequent side effect of the operation.[52, 53] It is important to note, however, that all studies were retrospective and that a preoperative examination of erectile function was not performed. The high percentage of postoperative retrograde

ejaculation is viewed as a negative influence on sexuality. Often, it is difficult for patients to differentiate between ejaculatory and erectile dysfunction.

Using a the Snap-Gauge test in 98 patients who underwent TURP it was estimated that Transurethral resection of the prostate has an overall risk of 8.3% of damage to erectile potency, which appears to be greater (11.1%) only if a patient older than 65 years has a prostatic adenoma with 10 *gm.* of resectable tissue[40]. Tscholl et al. reported that a small size of an adenoma was a risk factor for post-operative erectile dysfunction probably because of higher risks of capsular perforation. Conversely, in case of large adenoma, the cavernous nerves are more protected because of their distance from the site of the resection.

The data collected by Tscholl et al. implies the fact that this disturbance might be only temporary. In repeated postoperative ‘‘Snap-Gauge Studies’’ the majority (31/34; _81.7%) of patients who originally showed an objective impotence after surgery experienced an improvement in potency after three months. The reasons for this phenomenon are not yet known.

In a study of 83 preoperative potent men it was shown that postoperative impotence seemed to be caused by a capsular perforation in the region of the nerve bundles, especially in small prostates.[43] Other authors, however, believe that a venous occlusion syndrome of the dorsal prostatic vein plexus is responsible for postoperative impotence following TURP.[45]

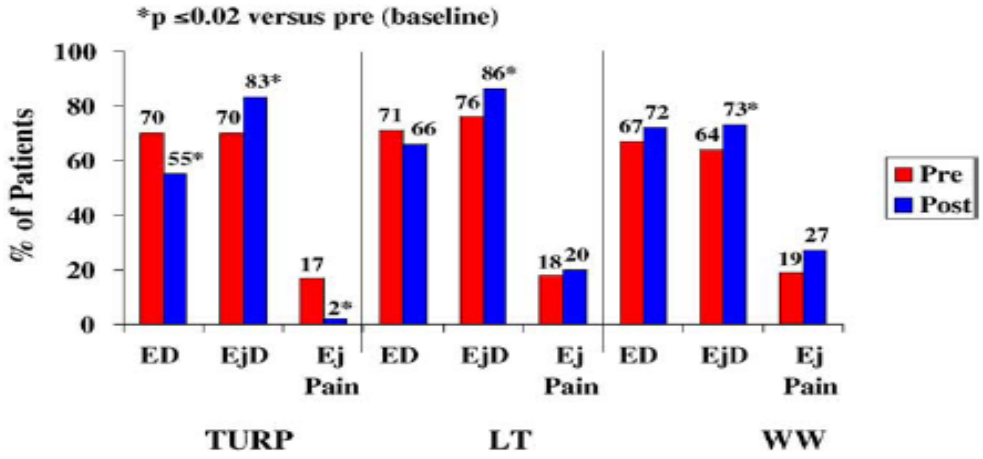
b. TURP & improved erectile function

VA Cooperative Study compared the outcomes of TURP and watchful waiting in 556 men with moderate [LUTS48]. In this study by Wasson et al symptomatic BPH patients were randomized either in a TURP group or a watchful-waiting group. TURP was not associated

with changes in general well-being, social activities, or sexual performance (*P*=0.92). At the end of the 3-year study, 19% of patients in the surgery group and 21% of those in the watchful waiting group reported that their sexual performance was worse, while 3% in each group reported it was improved suggesting worsening of baseline erectile function with untreated LUTS, and that surgical treatment would improve erectile function. Furthermore, men who had TURP were significantly less likely to have pain during ejaculation than those who had laser therapy or watchful waiting.

The results of this study indicate the spouses or partners thought that the patients' sexual performance was unaffected over the course of the study and that TURP has a more beneficial effect on certain aspects of sexual function (i.e., erectile function and pain during ejaculation) than is with watchful waiting.

A recent randomized, controlled trial evaluated ED and EjD (decreased amount of semen with ejaculation, loss of ejaculation, and pain/ discomfort during ejaculation) at baseline and 6 to 12 months after TURP, non-contact laser therapy, or watchful waiting in 340 men aged 48 to 90 year with LUTS/BPH.



TURP- transurethral resection of prostate WW – watchful waiting

LT – Laser therapy Ej pain- ejaculatory pain

A significant decrease from baseline in the percentage of men with ED & a significant reduction in the percentage of men with pain during ejaculation were demonstrated after TURP, when compared to Laser prostatectomy or watchful waiting. [54]

A prospective randomized trial in 2003 compared erectile dysfunction following TURP done with standard monopolar power in group 1 and done with Laser in group 2, followed up to 2 years postoperatively[55]. There was a marginal, insignificant improvement in the erectile function but no difference in the 2 groups. Prevalence of erectile dysfunction decreased from preoperative values of 53.3% and 51.6% to 51.6 % and 48.3% in groups 1 and 2, respectively. Significant deterioration in the mean IIEF orgasmic function and ejaculatory function domain scores postoperatively was reported with similar incidence in the 2 groups. A positive linear correlation was found between mean I-PSS, QOL and IIEF-EF domain score improvement after surgery, suggesting postoperative urinary symptoms and QOL amelioration on patient erectile function.

The cessation of preoperative medications, such as finasteride and α-blockers, might potentially have contributed to the reported slight postoperative improvement in sexual function.

c. Stable sexual function following TURP

There are studies noticing no change of erectile function following TURP.

Long-Term Effects on Sexual and Urinary Function and Quality of Life was studied by C. Deliveliotis et al in patients undergoing TURP. The sexual function was compared with an age-matched control population. 98 patients who underwent TURP for BPH were compared with a group of 80 apparently healthy men[56].

The general quality of life was estimated by the Rand 36-Item Health Survey 1.0. Urinary function was estimated by the AUA Symptom Index and the UCLA Prostate Cancer Index (urinary function and bother scale). Sexual function and bother, were explored using the Brief Male Sexual Function Inventory (MSFI) for Urology. Patient outcome 2 years post treatment was compared to the pre-treatment status and to that of the matched control population. General quality of life was not affected by TURP. TURP, as was expected, restored urinary function and bother to normal population norms. Elderly males had urinary function and bother similar to the operated patients. TURP marginally affects sexual life, mainly due to the loss of ejaculation, while in men from the control group, sexual function, although affected, was still present.

A recent report by H Leliefeld and colleagues[9] confirms the idea that the relation is coincidental. Prospectively, these investigators examined patients at baseline and 9 months after various treatments for BPH with questionnaires on voiding symptoms, related complications, and sexual function. 84% of patients reported no change in sexual function. All

modes of treatments showed both improvement and deterioration in 3–14% and 0–16% of patients, respectively.

In a prospective RCT by F MONTORSI et al 100 patients were randomized to TURP & HoLEP[57]. Erectile function of all patients was evaluated with IIEF, pre-operatively & at 1 yr post-operatively. Mean erectile function scores pre-operatively were 22.3 & 21.4 in the HoLEP & TURP groups, respectively. At 1 yr scores were 23.8 & 24.1 in HoLEP & TURP groups, respectively, with no statistically significant difference among them. This suggests a stable erectile function was maintained following TURP as well as HoLEP. There was no significant change in sexual desire, intercourse satisfaction & overall satisfaction in both the groups.

A total of 204 patients with bladder outflow obstruction (BOO) secondary to BPH were prospectively randomised 1:1 into either the PKEP group or the TURP group. IIEF scores were assessed pre-operatively and on follow up to 3 years. 38.2% patients in the Bipolar TURP group and 42.2% monopolar TURP group had potency sufficient for intercourse & were sexually active. Erectile function as assessed by IIEF scores, overall was, 19.4 +/- 5.1 (range 7–25), that in the saline TURP group was 19.3 +/- 4.6 (range 7–25) & in the TURP group was 19.6 +/- 4.8 (range 7–25). This was not significant different. Post-operatively the mean scores of erectile function in IIEF were 20.2 with saline TURP & 20.8 in the monopolar TURP group. Neither bipolar TURP nor TURP caused significant changes in erectile potency postoperatively[58].

The question of whether, and how often does TURP result in erectile dysfunction, cannot be answered conclusively by the current literature.

In any case, currently from the available literature pertaining to erectile function following TURP it is imperative to considered the following points,

1. pre-TURP patient education and clarification,

2. pre- and post TURP objective evaluation of erectile function,

3. strict indication for surgery in younger patients,

4. in potent, sexually active patients with a small prostate, a careful resection of the prostate in the area of the neurovascular bundle,

MATERIALS & METHODS

Materials & methods

All patients undergoing TURP for Benign prostatic hyperplasia were included in the study. Data was collected preoperatively with a detailed sexual history and evaluation regarding sexual dysfunction, which included IIEF questionnaire. Independent risk factors for erectile dysfunction were noted as in severity of LUTS using I-PSS, age of the patient & medical co-morbid conditions. Intra-operative findings were noted regarding duration of the procedure, amount of gland resected. The sexual function of the patients was evaluated by the IIEF questionnaire at 3 months postoperatively.

Data was analyzed for any change in the erectile function.

Setting: The study was conducted in the Department of Urology, CMC Hospital. The study spanned 1 year commencing March 2010. Recruitment was done for 9 months from March 2010 to November 2010 and the follow up was for 3 months from surgery.

Inclusion

All patients undergoing TURP for BPH who were sexually active were included in the study.

Exclusion

Patients with psychiatric disease, who have been treated for impotence, had prior TURP or other minimally invasive surgery for BPH or pelvic trauma or surgery, and those with carcinoma prostate diagnosed postoperatively on histopathology examination were excluded from the study.

Variables:

Primary outcome of this study was to assess erectile function following TURP done for BPH

The exposure was the surgery, namely transurethral resection of prostate (TURP).

Erectile function of the subject was assessed, as per IIEF questionnaire that was answered by the subject.

C) Primary outcome was the change in the erectile function that was assessed based on the IIEF (International Index of Erectile Function) questionnaire evaluating 5 domains of the male sexual function.

Scoring Algorithm for IIEF: All items are scored in 5 domains as follows:

Domain	Question numbers	Range Score	Max Score
Erectile Function	1, 2, 3, 4, 5, 15	0-5	30
Orgasmic Function	9, 10	0-5	10
Sexual Desire	11, 12	0-5	10
Intercourse Satisfaction	6, 7, 8	0-5	15
Overall Satisfaction	13, 14	0-5	10

The severity of ED was further classified into the following 5 categories: no ED (EF score, 26-30), mild (EF score, 22- 25), mild to moderate (EF score, 17-21), moderate (EF score, 11-16), and severe (EF score, 6-10).

Erectile function scores were compared before and after surgery.

The International Index of Erectile Function is a multidimensional, self-administered questionnaire for the clinical assessment of ED. This validated questionnaire has been shown to discriminate between men with and without ED. The erectile function (EF) domain of the questionnaire has also been shown to provide a reliable measure for classifying the severity of ED.

The International Index of Erectile Function was self-administered to each patient in their language. The 6 items on the EF domain included questions concerning erection frequency, firmness, penetration, maintenance frequency, maintenance ability, and erection confidence during the last 4 weeks. Each item was based on a 5-point Likert scale, and the responses to all 6 items were summed to arrive at a total EF score ranging from 1 to 30. Men who had made no attempt at sexual activity in the past 4 weeks were not included in the present analysis, which was restricted to those individuals with a total score of 6 or more. A higher score indicated relatively better EF. Previous evaluation of the EF domain had determined an optimal cutoff score of less than 26 for those having ED.

a. Data Sources/measurement:

Data regarding sexual function was collected by the primary investigator preoperatively and at 3 months postoperatively using IIEF questionnaire.

Sample size calculation

The proportion expected to undergo change in the status of erectile function 10% and a precision of statistical analysis to be +/-6% and the confidence interval to be 95%, the sample size was calculated to be 107 subjects.

Statistical methods: This is a prospective cohort study wherein the subjects were their own controls. For patients who defaulted at follow up, IIEF questionnaire was collected in person, by mail or telephonic interview.

With the available literature the expected change in the incidence of post-op ED may vary from an average of 15% --to—stable erectile function –to a possible improvement in the erectile function.

Erectile function was assessed for both normal & dysfunction on the same scale with a scoring system, scores ranging from 0- 30. Pre & post TURP statistical analysis was done with a paired t- test.

RESULTS

Results

A total of 107 who underwent TURP and were sexually active were included in the study. The mean patient age was 61.3 yr (range: 48 to 70 yr). Baseline features of these patients are as shown in the table below

Baseline parameters (mean)	**Values (range)**
Age (yr)	61.3 (48 – 70)
Mean AUA symptom score	16.1 (8 – 33)
IIEF score mean	52.07 (24 – 74)
Erectile function score mean	21.6 (7 -30)
Orgasm & ejaculatory function score, mean	7.94 (3 – 10)
Serum creatinine, mg%	1.2 (0.8 – 2.5)
Prostate size mean, gm	31.6 (20 – 50)

Effect of LUTS on erectile function as noted in literature is difficult to apply to this study group as the study group was not all LUTS patients but those with an indication for TURP and hence mean AUA symptom scores of the group can be expected to be higher. Mean AUA symptom score of these patients was 16.1. Sexual function, as assessed by IIEF scores, showed a mean value of 52.07 and the erectile function mean score was 21.6. Pre-Categorization of erectile function showed the following distribution pattern.

Erectile Function score categories (score over 30)	Number (n= 107)
No ED (26-30)	24
Mild ED (22-25)	37
Mild-moderate ED (17-21)	31
Moderate ED (11-16)	9
Severe ED (6-10)	6

Mean erectile function scores were noted to be different in 2 age groups less than or more than 65 yr of age.

	Entire group	Upto age 65 yr (n=78)	Above 65 yr (n= 29)	difference	Significance (p value)
IIEF score, mean	52.0748	53.87	46.93	6.94	0.018
EF scores	21.4206	22.5	18.2	4.3	0.02

In the age group of more than 65 yr the overall IIEF scores & erectile function scores were less than in patients with age up to 65 yr which was statistically significant.

Of the 107 study patients 22% had normal erectile function, 9 had moderate with 6 having severe erectile dysfunction. Most common occurrence of erectile function was seen in mild or mild to moderate ED category with 68 patients, nearly 2/3rd of total.

Data was analyzed for the effect of age on sexual function in patients with benign prostatic enlargement with LUTS in whom TURP is indicated.

The grade of erectile dysfunction varied with age.

Cross-tabulation of categories of erectile function groups in the 2 age groups							
		ED categories					**Total**
		No ED	**Mild ED**	**Mild-mod ED**	**Moderate ED**	**Severe ED**	
AGE	**≤65 yr**	**20** (25.6%)	31 (39.7%)	**23** (29.5%)	**2** (2.6%)	**2** (2.6%)	78
	>65 yr	**4** (13.8%)	**6** (20.7%)	**8** (27.6%)	**7** (24.1%)	**4** (13.8%)	29
Total		24 (22.4%)	37 (34.6%)	31 (29.0%)	9 (8.4%)	6 (5.6%)	107

Based on cross-tabulation of categories of the baseline erectile function scores, it was noticed that in **age group up to 65 yr** 95% of patients has up to mild-moderate ED, only 5.2 % had moderate to severe ED. In patients with **age more than 65 yr** 37.9% had moderate to severe ED prior to TURP.

Among patients with moderate & severe LUTS 70% were aged more than 65 yr.

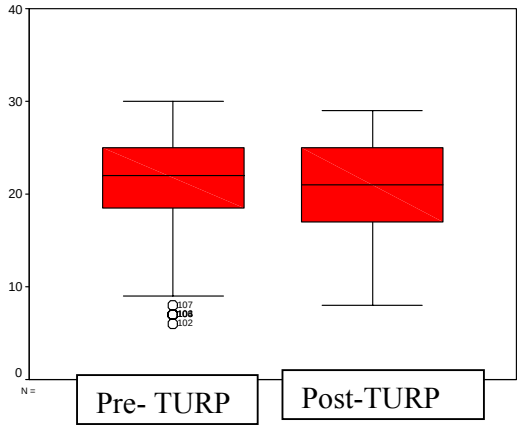
Following TURP IIEF scores at 3 months were collected. Pre-TURP & Post-TURP data are tabulated as below and Paired t- test analysis of these groups was done.

Paired Samples Test

1-Pre-TURP 2-Post TURP	Paired Differences					t	df	Significance
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
IPSS 1 – 2	15.7500	5.57249	.56874	14.6209	16.8791	27.693	95	.000
QOL 1 – 2	2.9720	1.03211	.09978	2.7741	3.1698	29.786	106	.000
IIEF 1 – 2	2.9252	4.77158	.46129	2.0107	3.8398	6.341	106	.000
Erectile function 1 – 2	.6262	2.31290	.22360	.1829	1.0695	2.800	106	.006
Intercourse satisfaction 1 – 2	-.0935	1.25542	.12137	-.3341	.1472	-.770	106	.443
Orgasm ejaculation Function 1 – 2	2.1776	1.46541	.14167	1.8967	2.4584	15.371	106	.000
Desire 1 – 2	.0748	1.11339	.10764	-.1386	.2882	.695	106	.489
Overall satisfaction 1 – 2	.0093	.87411	.08450	-.1582	.1769	.111	106	.912

After statistical analysis with paired t-test, the IPSS scores & QOL scores, as would be expected, improved significantly following TURP. Different aspects of sexual function as assessed by IIEF questionnaire, comparing Pre- & Post-TURP, showed that there was a decrease of ejaculatory & orgasmic function scores which has been well documented in the past. The sexual desire, intercourse satisfaction & overall satisfaction aspects of sexual function did not show any significant change following TURP.

However, erectile function & overall IIEF score scores decreased following TURP which attained statistical significance, as depicted below. A change in the overall IIEF scores is less meaningful than EF scores, in the context of the current study.



For descriptive statistics, to analyze the effect of age on erectile function, the study group was divided into 2 groups;

Group – I: up to age 65 yr (n= 78) &

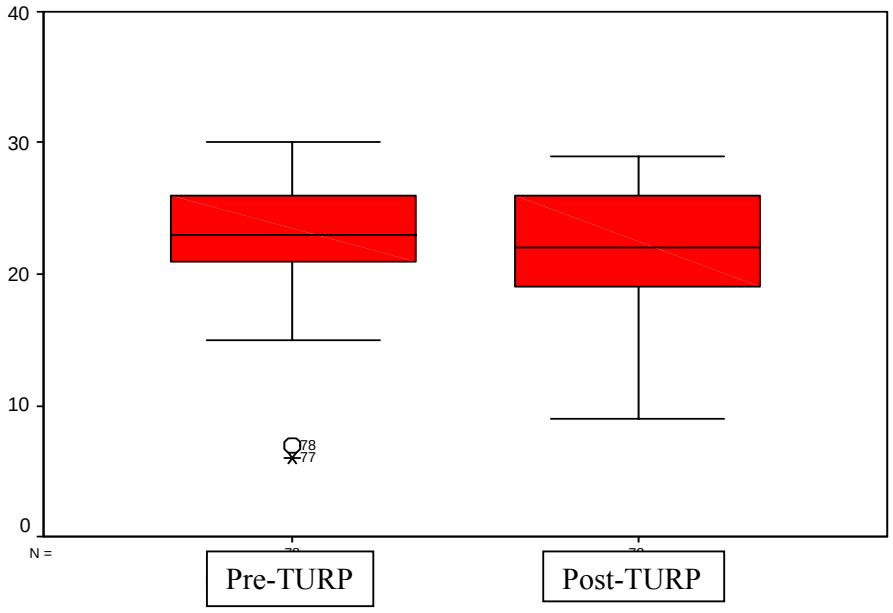
Group – II : more than age 65 yr (n= 29).

Group- I : Paired Samples Test

1: Pre-TURP 2: Post-TURP	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
IPSS1 - IPSS2	16.4930	5.71932	.67876	15.1392	17.8467	24.299	70	.000
QOL1 - QQL2	3.0256	1.04415	.11823	2.7902	3.2611	25.592	77	.000
IIEF1 - IIEF2	2.6410	5.18483	.58707	1.4720	3.8100	4.499	77	.000
Erectile function	**0.4615**	**2.35042**	**.26613**	**-.0684**	**.9915**	**1.734**	**77**	**.087**
Intercourse Satisfaction	-.1667	1.36198	.15421	-.4737	.1404	-1.081	77	.283
Orgasm ejaculation Function	2.2179	1.44732	.16388	1.8916	2.5443	13.534	77	.000
Desire	.0128	1.13382	.12838	-.2428	.2685	.100	77	.921
Overall satisfaction	-.0385	.85951	.09732	-.2323	.1553	-.395	77	.694
Gland size - Gland resected	14.7662	4.63084	.52773	13.7152	15.8173	27.981	76	.000

The erectile function scores did not change significantly following TURP, which is depicted in the box plot below, in the group 1 with subjects aged less than 65 yr.

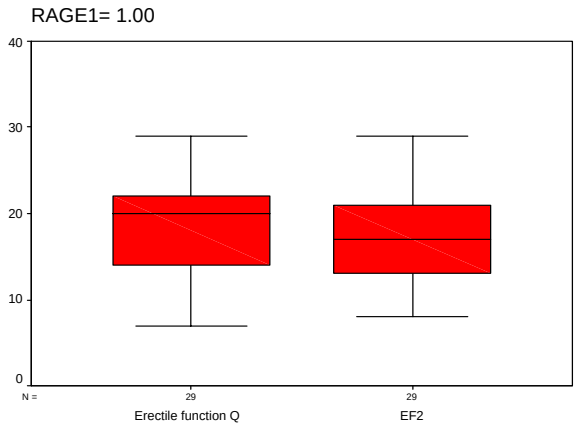
Erectile function Box plot



On subgroup analysis, in patient up to age 65 yr, n=78, the Erectile function scores did not show any statistically significant change in scores following TURP.

Group –II : Paired Samples Test

1-Pre-TURP 2-Post-TURP	Paired Differences					t	df	Sig. (2-tailed) p value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
IPSS1 -2	13.6400	4.60869	.92174	11.7376	15.5424	14.798	24	.000
QOL1 - 2	2.8276	1.00246	.18615	2.4463	3.2089	15.190	28	.000
IIEF1 - 2	3.6897	3.38171	.62797	2.4033	4.9760	5.876	28	.000
Erectile function EF1 - 2	1.0690	2.18650	.40602	.2373	1.9007	2.633	28	**.014**
Int Sat 1 - 2	.1034	.90019	.16716	-.2390	.4459	.619	28	.541
Orgasm ejaculation Function 1 -2	2.0690	1.53369	.28480	1.4856	2.6524	7.265	28	.000
Desire 1-2	.2414	1.05746	.19637	-.1609	.6436	1.229	28	.229
Overall satisfaction 1-2	.1379	.91512	.16993	-.2102	.4860	.812	28	.424
Gland size- Gland resected	15.6552	5.74006	1.06590	13.4718	17.8386	14.687	28	.000



In age group more than 65 yr, there was a decrease in mean erectile function scores which attained statistical significance. This had affected erectile function scores of the overall group.

Change in ejaculatory function & its effect on erectile function

The mean ejaculatory & orgasmic function scores pre & post-TURP were 7.9252 & 5.7477 respectively. The reduction in the ejaculatory function concurs well with the post-TURP association of retrograde ejaculation, which is seen in range of 60-90%. Of the 107 patients 90.66% (97 subjects) showed worsening of ejaculatory & orgasmic function, 9.34% (10 subjects) showed an improvement in the same.

Erectile function scores had remained stable in 71% (76 subjects), in 21.5% (23 subjects) deteriorated & in 7.5% (8 subjects) showed an improvement.

Data was analyzed to know whether, following TURP, the change in ejaculatory function scores correlated with the change in erectile function scores.

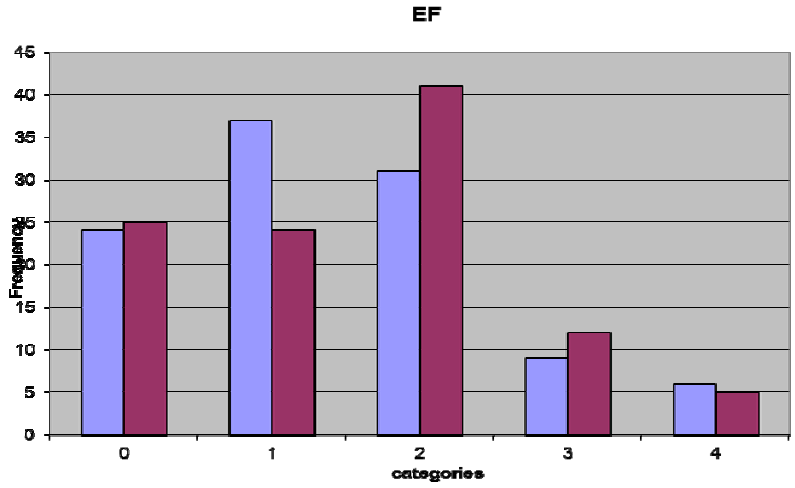
In group of stable erectile function, improvement of ejaculatory function scores was seen in 7 of 76 patients and in the rest 69 ejaculatory function scores worsened, ratio being nearly 1:10.

In the group with improved erectile function with 8 subjects, improvement of ejaculatory function scores was seen in ration of 1:7 against worsening.

In the group 23 subjects showing worsened erectile function following TURP, ejaculatory function scores improved in 2, keeping the ratio of improved to worsened ejaculatory function scores to nearly 1: 10. Following TURP, all 3 groups of erectile function scores showed the same pattern of change in ejaculatory function. The ratio of improvement to worsening of ejaculatory function scores had proportion of patients in all groups.

Categories of erectile function

The change in scores of erectile function **categories** pre & post TURP was analysed which showed a reduction of erectile function scores of the mild ED category.



To compare the change in scores of erectile function categories pre & post TURP, cross-tabulation of data was done.

Cross-tabulation							
		Post-TURP					**Total**
		No ED	**Mild**	**Mild-mod**	**Moderate**	**Severe**	
Pre-TURP	**No ED**	23	1				24
	Mild	2	18	17			37
	Mild-Mod		4	22	5		31
	Moderate		1	1	7		9
	Severe			1		5	6
Total		25	24	41	12	5	107

Findings noted on cross-tabulation

1. Patients with normal erectile function or no ED group maintained stable erectile function following TURP. None of them worsened to moderate or severe ED, only one patient had mild ED.

2. None of the patients with moderate ED worsened to severe ED.

3. One of 6 patients with severe ED & 2 of 9 with Moderate ED had an improved Erectile function score following TURP. This was not a statistically significant change as the numbers were less for subgroup analysis.

4. A deterioration of erectile function was noted in the following patients:

    a. 17 of 37 with mild ED had an Erectile function scores of mild – moderate ED post TURP, which was not significant.

    b. Of the 31 with mild-moderate ED, 4 improved to mild ED & 5 deteriorated to moderate ED.

5. 2 of moderate ED & 1 from severe ED improved on their erectile function scores.

Overall change of erectile function largely occurred in 2 groups with mild ED & mild-moderate ED, wherein patients had small change in erectile function to next category. There was no deterioration of erectile function from any of the categories to severe ED.

DISCUSSION

Discussion

The evaluation of sexual function in patients following TURP has shown that TURP is associated with discordant outcomes, with relation to the risk of postoperative ED. One of the reasons related to different tools used for evaluation, the older studies were retrospective evaluation of sexual function and used a variety of tools which were not standardized for assessment of erectile function in the setting of a clinical trial.

Impotence has been reported at a rate of 4–40% in several early studies but this rate now is thought to be an overestimation.

Indian data on this is sparse, done with poorly validated questionnaires.

The effect of TURP on erectile function in our study group, as assessed by IIEF questionnaire, showed a significant reduction of erectile function scores, pre-TURP mean values of 21.42 to 20.97 & the overall sexual function as noted in IIEF scores from mean values of 52.07, to 49.14.

As detected in the multicenter American Urological Association Cooperative Study the prevalence of postoperative ED reported in a retrospective meta-analysis that included 3,304 patients treated with TURP was 13.6%[8].

In contrast, results in a recent report of Leliefeld et al [9] 84% did not report any change in sexual function and no significant differences were found among the groups of BPH, medical management & TURP for BPH.

On the other hand, the only study that compared watchful waiting with TURP demonstrated a 20% lower rate of EF in the untreated group and did not show an increase in ED prevalence in the TURP group, which was monitored for up to 3 years after the procedure.[48]

Comment on baseline parameters of age, LUTS on erectile function

In our study subjects before TURP 77% had some degree of ED. In the age group of less than 65 yr 25% had normal erectile function, mild ED & mild- moderate ED was seen in 70% and **moderate – severe ED was seen in only 5%** of patients.

Those aged more than 65 yr only 14% had normal erectile function, 49% has mild Ed - moderate ED and **37% has moderate- severe ED**.

Worldwide the prevalence of ED, studies conducted between 1993 and 2003, stratified by age showed a rising prevalence of ED. Before age 40 the rate was 1% to 9%; from 40 to 59 it ranged from 2% to 9% to as high as 20% to 30%[30].

In the Massachusetts Male Aging Study (MMAS) study[32], ED had a high prevalence with 52% of men reporting some degree of erectile dysfunction—mild in 17.1%, moderate in 25.2% and complete in 9.6s. %. The prevalence of complete ED was age-dependent, increasing from 5% for men aged 40 years to 15% for those aged 70 years.

In the Massachusetts Male Aging Study MMAS (Johannes et al, 2000) a longitudinal study conducted between 1987 and 1997, the average age of men at baseline was 52.2 years & between the ages of 40 and 70 years, the probability of complete ED increased from 5.1% to 15%, moderate dysfunction increased from 17% to 34%, and mild dysfunction remained constant at about 17%[33].

In Multinational Survey of the Aging Male MASM-7 the prevalence of ED was 31%, 55%, and 76% in men aged 50 to 59 years, 60 to 69 years, and 70 to 80 years, respectively[2].

The above mentioned epidemiologic studies demonstrated a deterioration of sexual dysfunction with aging. Our data confirm the evidence of this relationship in aging men.

Effect of LUTS on erectile function has been studied extensively and is found to be an independent risk factor for sexual dysfunction irrespective of age. It has been shown that worsening of erectile function is seen with progressively severe LUTS.

The results of the population based studies of LUTS and ED cannot be extrapolated to patients in our study as the two groups are not comparable, this study group is expected to have higher degree of bothersome LUTS as the have an indication for TURP because of natural history of progression of BPH and a few patients have failed medical management. However, the mean IPSS score of this group was 16.1.

Based on the patients' self-assessments our data demonstrates that TURP very effectively alleviates bothersome LUTS due to BPH.

The well-known complication of TURP on ejaculation[70], that is, retrograde ejaculation or decreased ejaculate volume, was confirmed in our study.

In a population based prevalence study 52% of men aged 40–70 years have some degree of SD, and two thirds of these men have moderate to severe LUTS, a**s noted in Cologne Male Survey &** multinational UrEpik study.

The relative risk of ED stratified by International Prostate Symptom Score (IPSS) ranged from a relative risk 1.0 at IPSS 0 to a 3.3 fold increase in relative risk for IPSS greater than 19[21].

Following TURP there was a change in the overall IIEF score and erectile function scores

Our results suggest that there are 70% of patients (75 patients) maintained a stable erectile function following TURP. This data confirms the finding of stable erectile function following TURP as shown in prospective RCT by F MONTORSI [57]et al & the study by Zhigang Zhao et. Al[58].

In our study, 9 patients (8.5%) of patients in the whole group experienced an improvement of their erectile function. 2 of 9 patients with moderate ED & 1 of 6 with severe Ed showed improvement in their erectile function. Possible factors contributing to this improvement could be improvement in the LUTS, improvement in the baseline ejaculatory dysfunction or discontinuation of medication for BPH contributing to ED. An improvement of erectile function has also been shown to occur in previous studies by Wasson et al[48] & Brookes et al[54].

21.5% of patients (23 patients) showed deterioration in their erectile function. Of these 74% (17 of them) were in mild ED category and 22% of patients (5 patients) were of mild-moderate ED group.

Change of erectile function scores noted in different categories of erectile function.

46% of patients with mild ED worsened to mild-moderate ED group and 16% of patients with mild-moderate ED worsened to moderate ED.

Subgroup analysis revealed that reduction in erectile function was significant only in age group above 65yr, a finding that was noted by Rete scholl et al[40].

Most studies report only on the incidence of de novo erectile dysfunction after TURP and not on the proportion of patients experiencing a change of sexual function. Our study demonstrated that reduction of erectile function occurred only in 2 categories of ED- mild ED & mild-moderate ED. This reduction in erectile function score did not correlate with occurrence of retrograde ejaculation. Incidence of retrograde ejaculation was similar across all categories of ED & in was also similar in groups with improved / stable / worsened erectile function following TURP.

CONCLUSION

CONCLUSION

Salient outcomes noted in this study were

1. TURP resulted in a reduction in the erectile function which was statistically significant in one fifth of patients.

2. A significant reduction was seen **only** in age group more than 65 yr & only those with Mild & Mild-moderate ED categories. This did not have a correlation with change in ejaculatory function.

3. All patients with normal erectile function and those with age less than 65 yr maintained a stable erectile function. There was no deterioration in patients with category moderate ED groups.

4. There is no risk of large scale deterioration of erectile function categories.

5. No instance of de-novo complete ED was noted following TURP, only a small downgrading by 1 category of ED can be expected in selected patients.

    a. In the subgroups which had deterioration, the risk was of a small magnitude (down grading by one category)

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APPENDIX

Appendix

IIEF questionnaire

1. **Over the past 4 weeks**, how often were you able to have an erection during sexual activity?

0. no sexual activity
    1. almost never/ never
    2. a few times (much less than half the time)
    3. sometimes (about half the time)
    4. most times (much more than half the time)
    5. almost always/ always

2. **Over the past 4 weeks**, when you had erections with sexual stimulation, how often were your erections hard enough for penetration?

0. no sexual activity
    1. almost never/ never
    2. a few times (much less than half the time)
    3. sometimes (about half the time)
    4. most times (much more than half the time)
    5. almost always/ always

3. **Over the past 4 weeks**, when you attempted sexual intercourse, how often were you able to penetrate (enter) your partner?

0. did not attempt intercourse
    1. almost never/ never
    2. a few times (much less than half the time)
    3. sometimes (about half the time)
    4. most times (much more than half the time)
    5. almost always/ always

4. **Over the past 4 weeks**, during sexual intercourse, how often were you able to maintain your erection after you had penetrated (entered) your partner?

0. did not attempt intercourse
1. almost never/ never
2. a few times (much less than half the time)
3. sometimes (about half the time)
4. most times (much more than half the time)
5. almost always/ always

5. **Over the past 4 weeks**, during sexual intercourse, how difficult was it to maintain your erection to complete intercourse?

0. did not attempt intercourse
1. extremely difficult
2. very difficult
3. difficult
4. slightly difficult
5. not difficult

6. **Over the past 4 weeks**, how many times did you attempt sexual intercourse?

0. no attempts
1. one to two attempts
2. three to four attempts
3. five to six attempts
4. seven to ten attempts
5. more than eleven attempts

7. **Over the past 4 weeks**, when you attempted sexual intercourse, how often was it satisfactory for you?

0. did not attempt intercourse
1. almost never/ never
2. a few times (much less than half the time)
3. sometimes (about half the time)
4. most times (much more than half the time)
5. almost always/ always

8. **Over the past 4 weeks**, how much did you enjoy sexual intercourse?

0. no intercourse
    1. no enjoyment
    2. not very enjoyable
    3. fairly enjoyable
    4. highly enjoyable
    5. very highly enjoyable

9. **Over the past 4 weeks**, when you had sexual stimulation or intercourse, how often did you ejaculate?

0. did not attempt intercourse
    1. almost never/ never
    2. a few times (much less than half the time)
    3. sometimes (about half the time)
    4. most times (much more than half the time)
    5. almost always/ always

10. **Over the past 4 weeks**, when you had sexual stimulation or intercourse, how often did you have the feeling of orgasm or climax?

0. did not attempt intercourse
    1. almost never/ never
    2. a few times (much less than half the time)
    3. sometimes (about half the time)
    4. most times (much more than half the time)
    5. almost always/ always

11. **Over the past 4 weeks**, how often did you feel sexual desire?

    1. almost never/ never
    2. a few times (much less than half the time)
    3. sometimes (about half the time)
    4. most times (much more than half the time)
    5. almost always/ always

12. **Over the past 4 weeks**, how would you rate your level of sexual desire?

1. very low/ none at all
2. low
3. moderate
4. high
5. very high

13. **Over the past 4 weeks**, how satisfied were you with your overall sex life?

1. very dissatisfied
2. moderately dissatisfied
3. about equally satisfied and dissatisfied
4. moderately satisfied
5. very satisfied

14. **Over the past 4 weeks**, how satisfied were you with the sexual relationship with your partner?

1. very dissatisfied
2. moderately dissatisfied
3. about equally satisfied and dissatisfied
4. moderately satisfied
5. very satisfied

15. **Over the past 4 weeks**, how do you rate your confidence that you could have and keep an erection?

1. very low
2. low
3. moderate
4. high
5. very high

Scoring Algorithm for IIEF

All items are scored in 5 domains as follows:

Domain	Items	Range	Score Max Score
Erectile Function	1, 2, 3, 4, 5, 15	0-5	30
Orgasmic Function	9, 10	0-5	10
Sexual Desire	11, 12	0-5	10
Intercourse Satisfaction	6, 7, 8	0-5	15
Overall Satisfaction	13, 14	0-5	10

Clinical Interpretation

I. Erectile function total scores can be interpreted as follows:

Score	Interpretation
0-6	Severe dysfunction
7-12	Moderate dysfunction
13-18	Mild to moderate dysfunction
19-24	Mild dysfunction
25-30	No dysfunction

Information sheet

The proposed surgery TURP is offered for lower urinary tract symptoms secondary to benign prostatic enlargement. It is uncertain whether this surgery would definitely affect erectile function at all and this aspect is being studied. This will be studied with the help of a questionnaire before and after the surgery which involves participation of subject and his spouse.

The expected duration of subject's participation in the study is 3 months from the date of surgery.

TURP is an established standard procedure for the past few decades in the surgical treatment of bladder outflow obstruction secondary to benign prostatic hyperplasia. The questionnaire used in this study to assess the erectile function is also a validated widely accepted tool. No novel procedure is being evaluated in this study and there is no foreseeable risk or discomfort that is likely to harm the subject. There will not be any monetary benefits to the subject participating in the study.

There is no foreseeable trial related injury and hence no scope for compensation of any sort. Participation is voluntary, that the subject can withdraw from the study at any time and that refusal to participate will not involve any penalty or loss of benefits to which the Subject is otherwise entitled.
For trial related queries and rights of Subjects the primary investigator, DR PRADEEP, is to be contacted. On participating in the trial it is the Subject's responsibility to be willing to provide the details necessary at 3 months following surgery.

Informed Consent form to participate in a clinical trial
Study Title:
Study Number:
Subject's Initials: _____ Subject's Name: _____
Date of Birth / Age:_____
Please initial box
(Subject)
(i) I confirm that I have read and understood the information sheet dated _____ for the above study and have had the opportunity to ask questions. [ ]
(ii) I understand that my participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. [ ]

(iii) I understand that the Sponsor of the clinical trial, others working on the Sponsor's behalf, the Ethics Committee and the reguiatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published. [ ]

(iv) I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s) [ ]

(v) I agree to take part in the above study. [ ]

Signature (or Thumb impression) of the Subject/Legally Acceptable Representative:_____

Date: _____/_____/_____

Signatory's Name: _____

Signature of the Investigator: _____

Date: _____/_____/_____

Study Investigator's Name: _____

Signature of the Witness: _____

Date:_____/_____/_____

Name of the Witness: _____

KEY WORDS

ED Erectile dysfunction

EjD Ejaculatory dysfunction

HD Hypoactive sexual desire

MSD Male sexual dysfunction

IPSS International prostate symptom score

AUA Score American Urology association symptom score

MMAS Massachusetts Male Aging Study

MASM Multinational Survey of the Aging Male

NHSLS National Health and Social Life Survey

IIEF International index of Erectile Function

LUTS Lower urinary Tract Symptoms

BPH Benign Prostatic Hyperplasia

H. No	Age	IPSS		QOL		IIEF		Erectile function
		Pre-op1	post-op2	Pre-op	post-op	Pre-op	Post-op	Pre
776386D	70	17	3	4	1	45	43	14
750180D	60	32	2	5	0	41	40	17
349394C	62	20	3	2	0	54	48	24
781762D	60	16	3	3	0	47	53	23
003270D	65	26	2	5	0	46	42	18
771992D	52	21	2	3	1	38	55	15
766772D	55	on cbd	2	3	0	24	28	7
763881D	68	11	1	2	1	54	45	20
787769D	69	13	4	2	1	44	33	16
777822D	62	17	4	4	0	53	49	23
008674B	55	27	2	6	1	74	67	30
783678D	61	23	2	5	3	45	39	17
779523D	65	17	3	4	1	52	54	21
702400D	54	on cbd	2	5	0	46	45	19
751456D	67	19	2	3	0	24	28	7
964615C	67	8	1	3	1	53	50	21
803449D	68	26	2	5	0	52	48	21
639393D	48	11	1	4	1	55	50	23
000612D	54	19	2	3	0	60	64	28
368389A	65	25	3	4	1	54	53	23
793394D	62	15	3	2	0	52	48	22
507353D	61	12	3	3	0	47	53	23
596571D	63	26	2	5	0	52	48	21
810943D	60	16	2	3	1	72	67	29
364432D	67	15	3	4	1	27	26	9
574802B	58	16	1	2	1	62	57	26
805546D	55	27	2	5	0	51	45	21
776207D	61	on cbd	2	3	1	58	54	25
816453D	59	13	4	2	0	62	57	25
573303D	60	23	2	4	0	65	62	27
798748D	66	9	1	4	1	64	58	29
790513D	70	cbd	1	5	1	62	62	27
500443C	62	25	9	4	2	57	44	23
767262D	55	23	2	4	1	68	62	29
735921D	58	11	1	4	1	55	50	23
760711D	53	21	2	4	1	58	57	24
677991D	67	11	1	4	1	52	45	20
740902D	62	11	3	4	2	47	45	22
755075D	50	on cbd	3	4	1	43	41	21
381608D	64	11	1	2	1	61	56	25
691179D	53	24	2	5	0	50	44	20
775100D	66	on cbd	2	3	1	63	59	27

765419D		65	13	4	2	0	62	57	25
302801D		58	23	2	4	0	65	62	27
689459D		66	9	1	4	1	64	58	29
754924D		52	cbd	1	5	1	62	62	27
733085D		63	25	9	4	2	57	44	23
749370D		63	12	3	3	0	47	53	23
722543D		65	15	3	4	1	42	40	22
425927B		57	16	2	3	1	72	67	29
699732D		61	23	2	5	3	45	39	17
595499C	68		14	1	4	1	44	41	19
584364D		59	25	3	4	1	54	53	23
724576D	66		15	3	2	0	52	48	22
138099D		59	26	2	5	1	63	58	26
593204D		64	11	1	4	1	45	42	15
227169C		63	21	2	4	1	58	57	24
369467D		59	18	2	5	2	47	41	19
704391D		57	23	2	5	3	45	39	17
603327C		68	18	1	3	0	51	46	21
707151D		58	on cbd	1	4	1	64	58	29
722621D		55	13	1	4	0	64	65	30
005916C		59	19	2	3	0	60	64	28
697794D		53	25	3	4	1	54	53	23
725592D		58	15	3	2	0	52	48	22
704121D		63	12	3	3	0	47	53	23
717450D		64	26	2	5	0	52	48	21
706234D		68	on cbd	3	2	0	41	39	12
702866A		64	13	1	3	1	54	45	23
313508D		59	16	2	3	1	29	50	6
597249C		68	17	3	4	1	44	42	13
713206D		60	33	2	5	0	41	40	17
516278B		69	19	2	3	0	24	28	7
960271C		64	8	1	3	1	53	50	21
835001C		68	15	3	4	1	42	40	22
696725D		56	11	1	2	1	61	56	25
692498d		52	18	1	3	0	51	52	21
685973D		57	26	2	5	1	63	58	26
674257D		60	11	1	4	1	55	50	23
850936C		60	21	2	4	1	58	57	24
697067D		64	18	2	5	2	47	41	19
697024D		64	9	1	4	1	64	58	29
288049D		48	16	0	3	1	62	61	27
562710D		58	14	3	3	0	68	68	28
263996D		63	20	1	5	1	50	47	18
674067D		67	16	3	4	1	42	40	22
676173D		67	14	1	2	1	35	30	8
658865D		53	29	2	6	1	74	67	30
673378D		65	22	2	5	3	45	39	17

656373D	67	cbd	1	4	1	55	47	23
673781D	66	19	1	5	1	50	47	18
629614D	66	16	2	3	1	45	43	14
525303D	60	17	4	4	0	53	47	23
389654D	67	28	2	6	1	48	40	14
645883D	62	cbd	2	5	3	45	39	17
652184D	60	15	2	3	0	66	65	27
650908D	69	14	3	3	0	43	39	14
634339D	67	19	1	5	1	42	38	14
652982D	63	22	3	2	0	54	48	24
649406D	62	20	3	4	1	50	40	20
612979D	64	23	2	5	1	60	56	25
646624D	63	11	1	4	1	52	50	21
641440D	48	20	1	4	1	62	59	26
629368D	59	18	2	5	2	46	42	18
627767C	67	15	3	2	0	51	44	22
647990D	66	14	2	3	0	48	47	23
709897D	48	15	3	4	1	42	40	22

ED category-pre TURP	Erectile function post	ED category-postTURP	Intercourse Satisfacti		Orgasm & ejaculatio		Desire	
			pre	post	pre	post	Pre	Post
3	13	3	9	10	8	5	7	8
2	17	2	6	7	9	6	4	6
1	21	2	8	8	9	7	6	6
1	24	1	6	8	4	5	8	9
2	18	2	7	7	9	5	6	5
3	24	1	5	10	6	5	6	8
4	9	4	6	6	3	5	6	5
2	16	2	11	10	9	6	8	8
3	14	3	7	6	7	4	7	5
1	21	2	7	8	8	6	8	8
0	28	0	14	14	10	6	10	9
2	15	3	8	8	7	5	6	4
2	21	2	9	11	8	6	7	8
2	19	2	7	8	9	6	5	7
4	9	4	6	6	3	5	6	5
2	22	1	8	8	9	6	7	7
2	21	2	8	8	9	5	7	6
1	22	1	10	9	8	5	6	6
0	29	0	9	12	9	7	6	8
1	22	1	9	8	8	8	6	7
1	21	2	8	8	9	7	6	6
1	24	1	6	8	4	5	8	9
2	21	2	8	8	9	5	7	6
0	27	0	14	12	9	8	10	10
4	8	4	4	5	5	3	5	5
0	27	0	11	12	9	6	8	8
2	19	2	8	7	9	6	7	7
1	24	1	9	9	8	6	7	7
1	25	1	11	11	9	5	9	8
0	27	0	12	13	10	6	7	7
0	29	0	9	7	10	8	8	6
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Overall satisfaction	
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